

저출력 레이저의 생체활성조절 효과

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Biomodulation Effect of the Low-Level Laser Therapy(LLLT)

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4)

서 론

가 .

(High - power) 1974

(Low - power) 3000~10000 mW (low level laser therapy,

LLLT) 30

1~500 mW

energy) . 1) (photo . 1980 632.8 nm He - Ne laser

가 . 5) 1990

가 (630~670 nm) (830~1300 nm) diode laser

가 .

가

LLLT

(healing) (pain relief) (anti - inflammation effect), (immunosup-

(Bio - (improved blood circulation), (vasodilatation), (im-

stimulation effect) 2)3) (analgesic effect),

(anti - edematous effect), (sti-

1962 mulation of wound healing)

, 1960 가 Endre Mester가 Laser (low

: , 330 - 715 16 level laser blood irradiation, LBI) 6-8) LBI

가 LLLT ,

: (041) 550 - 3975 . : (041) 556 - 1090 , (blood

E - mail : pschung@dku.edu microcirculation)

가 (platelet degranulation),
 9-13) LBI(IR - LBI) 가 (en-
 cytokine 가 (fibroblasts)가
 dothelial cell
 40% "wound fibroblast"
 (collagen)
 30% 5
 가
 14-16)
 가
 LLLT
 (Table 1).
 가 Mester 4) 가
 17)
장상치유 증진효과
 30 60 mW diode
 (inflammation), (proliferation), 가
 (synthesis), (maturation)
 18)

Table 1. The area for clinical application of low-level laser therapy in medicine

Medical fields	Application
Cardiology	Ischemic heart disease, stenocardia, myocardial infarction
Otorhinolaryngology	Pharyngitis, tonsillitis, maxillary sinusitis, tracheitis, otitis
Gastroenterology	Gastritis, stomach ulcer and duodenal ulcer, cholecystitis, pancreatitis, hepatitis, colitis
Dermatology	Dermatitis, dermatosis, neurodermite
Pulmonary diseases	Bronchial asthma, pneumonia, pleuritis
Gynecology	Mastitis, inflammations, erosions, generic and postnatal complications
Urology	Adenoma, prostatitis, cystitis, urethritis, nephritis, pyelonephritis, urolithic disease
Proctology	Hemorrhoids, proctitis, anal pruritus and fissures
Neuropathology	Neuritis of upper and lower extremities, radiculitis, neuralgia of the head and face
Arthrology	Diseases of joints and vertebral column
Stomatology	Caries, pulpitis, periodontitis, paradontitis

Karu 가 가 DNA
, 620 nm , 760 nm 404 nm 454 nm
가 , ATP , DNA & RNA 830 nm¹⁹⁾
mitochondria , ATP , DNA & RNA pH
, , ,²⁰⁾²¹⁾
Mouse 유발상에서 저출력레이저치료의 상치유 증진효과
LLLTL
mouse

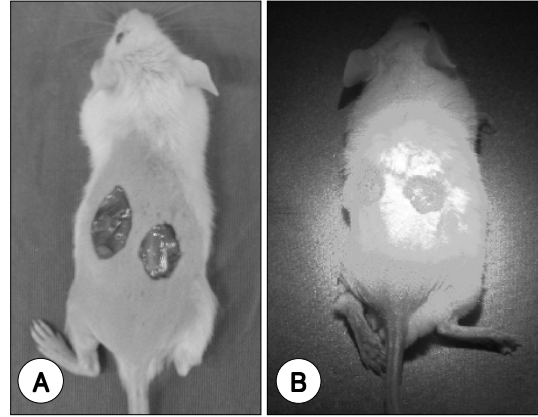


Fig. 1. A : Control group, B : DPSS laser group.

Table 2. Criteria for scoring histologic sections

Score	Parameter	Criteria	
1 - 3	Epithelialization	None to very minimal	
	Cellular content	None to very minimal	
	Granulation tissue	None to sparse amount	
	Collagen deposition	None	
	Vascularity	None	
4 - 6	Epithelialization	Minimal (less than half of diameter) to moderate (more than half of diameter)	
	Cellular content	Predominantly inflammatory cells	
	Granulation tissue	None to thin at wound center	
	Collagen deposition	Few collagen fibers	
	Vascularity	Few capillaries	
7 - 9	Epithelialization	Completely epithelialized	
	Cellular content	More fibroblasts, still with inflammatory cells	
	Granulation tissue	7, sparse at wound center 8, thin layer at wound center, few collagen fibers 9, thicker layer, more collagen	
	Collagen deposition	Moderate collagen fibers	
	Vascularity	Moderate neovascularity	
	10 - 12	Epithelialization	Thicker epithelial layer
		Cellular content	Predominantly fibroblasts
		Granulation tissue	Uniformly thick
		Collagen deposition	Moderate-to-extensive collagen deposited
Vascularity		Extensive neovascularity	
13 - 15	Epithelialization	Thick epithelium	
	Cellular content	Fewer number of fibroblasts in dermis	
	Granulation tissue	Uniformly thick	
	Collagen deposition	Dense, organized, oriented collagen fibers	
	Vascularity	Well-defined capillary systems	

DPSS (Diode Pumped Solid State, 532 nm)

(Fig. 1). () 3, 7, 10
 (%) 24.0±2.7, 42.8±5.0,
 71.4±4.0, DPSS 33.2±2.4,
 20 mm 3, 7, 64.8±3.5, 82.2±7.9 . 3
 10

가 가 (Fig. 2).
 (wound epithelialization), (cellular content),
 (granulation tissue formation),
 (collagen deposition), (neovasculariz-
 ation) 5가
 (Table 2).

3, 7, 10
 (histologic score) 3.6±1.1, 7.0±1.0, 9.0±
 0.7, DPSS 3.4±0.9, 9.0±
 0.7, 10.8±0.8 .
 7 DPSS
 가 가 (Fig. 3).

모발성장 촉진효과

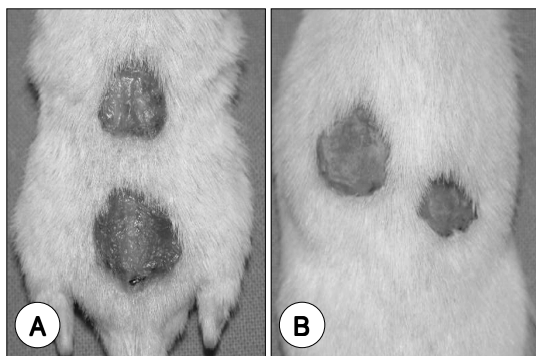


Fig. 2. Gross finding at 7 days in control (A), DPSS laser (B). Note for more extensive whitish, crust formation at both laser group than control group.

가

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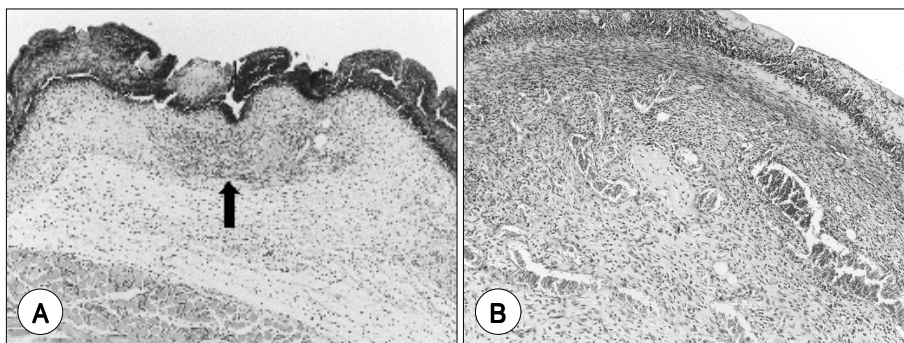


Fig. 3. Histologic finding at 7days in control (A), DPSS laser (B). A : Control group, at 7 days, Note for thin layer of granulation tissue at wound center and moderate epithelialization change (histologic score : 6, based on Table 1. H & E staining, × 100), B : DPSS laser group, at 7 days, Note for multiple extensive neovascularization (histologic score =10, based on Table 1. H & E staining, × 100).

1200 nm intense pulsed light
(nevus flammeus)
(terminal hair)
가 2

가
2003 Satino²³⁾ 35
(:28 , :7)
(HairMax LaserComb, Lexington Inter-
national, Boca Raton, FL,) 6 2
5~10

(tensile
strength) 가
가 가
가
, adenosine triphosphatase(ATP)
가

모발을 포함하는 주변 조직에 대한 효과
(hair follicle)
(hair shaft,)

Laser

모낭에 대한 직접적인 효과
Laser
(hair papilla)
가 (hair bulb)가
. Laser

두피 염증반응에 대한 효과

가

저출력 레이저가 마우스 모발성장엔 미치는 효과

LLLT
890 nm
diode (5 mW)(() ,) 20
1 (Fig. 4) 1 1
1, 7, 9, 15, 25

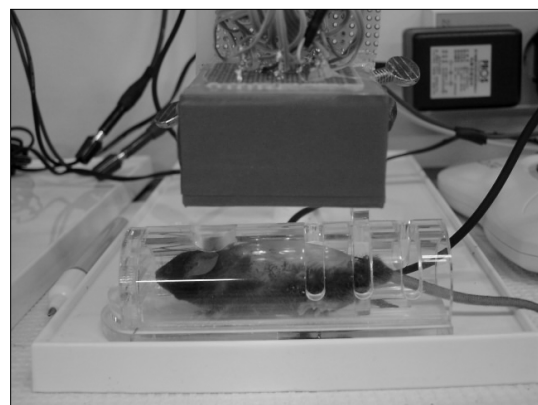


Fig. 4. The photograph of low-power laser irradiation on the back skin of the mouse.

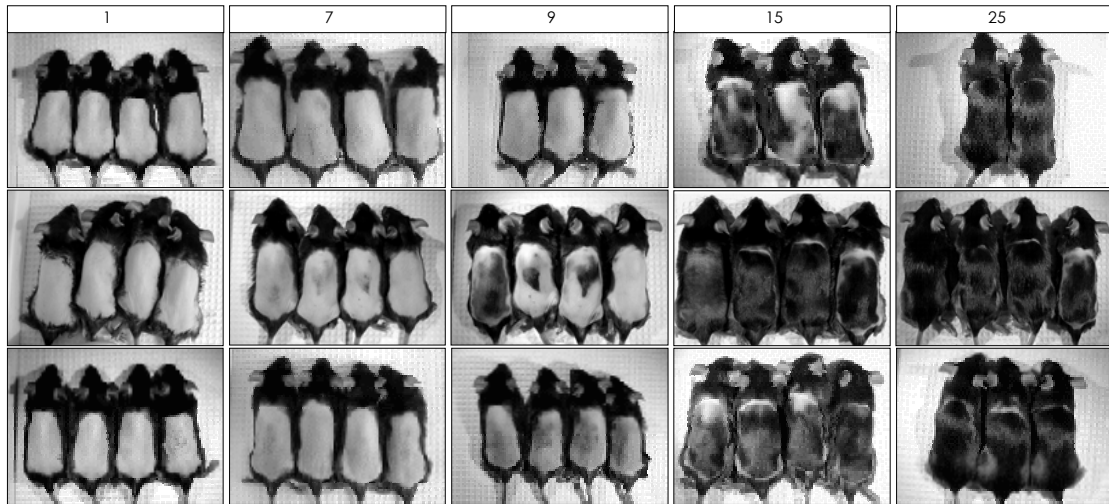


Fig. 5. Change of the gross morphology of hair growth in the depilated area of mice according to the duration : Control (upper), Laser irradiation group (middle), MoenMore applied group (lower).

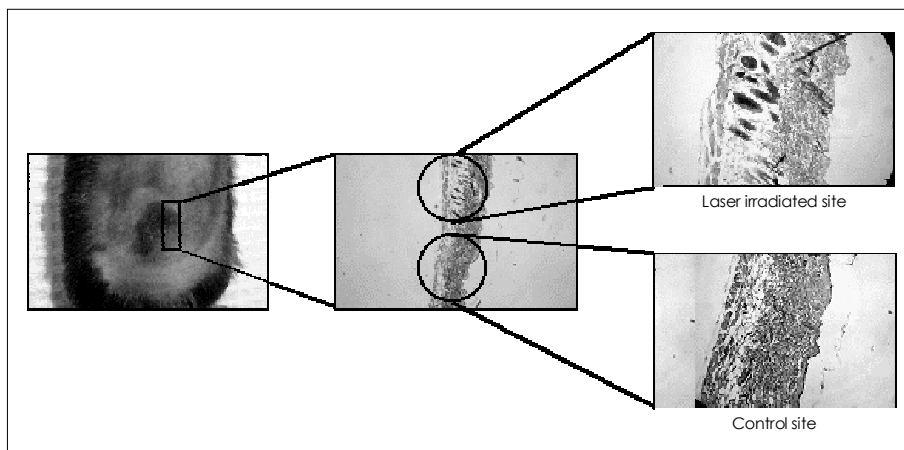


Fig. 6. The histopathologic findings of the mouse skin at the 12th day after depilation.

(Fig. 6).

25

13

결 론

9

20

가

(Fig. 5).

12

중심 단어 :

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